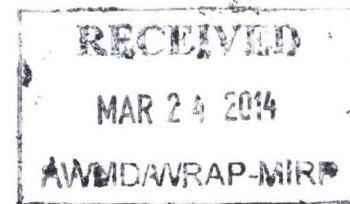




STINSON
LEONARD
STREET

Sarah Toevs Sullivan
816.691.2610 DIRECT
816.412.9328 DIRECT FAX
sarah.sullivan@stinsonleonard.com



March 21, 2014

Mr. Jay Liu
Project Manager - Permits Section
Missouri Department of Natural Resources
Hazardous Waste Program
PO Box 176
Jefferson City, MO 64102-0176



Re: Response to MDNR Correspondence - November 25, 2013

Dear Mr. Liu:

This letter is submitted on behalf of Expert Management Inc. (EMI), and provides EMI's comments in response to your letter of November 25, 2013, addressed to Mr. David R. Zoghby of EBV Explosives Environmental Company (EBV) d/b/a General Dynamics Ordnance and Tactical Systems Munitions Services (General Dynamics), a copy of which was hand delivered to EMI on November 25, 2013. In July 2013, EBV announced its proposed Class 3 permit modification to construct a new Grenade Demil Building at its facility. On September 23, 2013, EMI submitted comments to MDNR raising concerns about the proposed modification, particularly in light of increasing perchlorate concentrations in groundwater believe to be emanating from EBV's facility.

The purpose of this letter is to address specific comments posed by EBV during its September 26, 2013 meeting with MDNR, as documented in the Conference Record. Since submitting its proposed Class 3 permit modification, we understand EBV has applied for a separate Class 2 RCRA permit modification to increase its hazardous waste feed capacity in Building #3 and its hazardous waste storage capacity at the facility by 25 percent. EBV also is pursuing a Class 2 air permit modification to add two additional rocket motor variants to its feed material in its Propellant Thermal Treatment System. In light of EBV's greatly expanded hazardous waste activities and its plans for still more expansion, it is important that the apparent releases of hazardous constituents from its facility be identified and addressed as required by its permit.

This letter includes some analysis of EMI's most recent groundwater and surface water sampling data collected as part of EMI's 2013 groundwater and surface water Corrective Action monitoring event. The 2013 data discussed herein was submitted to MDNR in the March 1 Groundwater Corrective Action Report (July-December 2013). This letter focuses on the North Wetlands Ditch, but EMI understands that the effects of the potential releases from EBV's facility may not be limited to the North Wetlands Ditch.

Enclosed are **Figures 1, 2 and 3** for reference. **Figure 1** is an area site plan of the EBV operations, EMI's adjacent property showing areas of concern and monitoring locations, as

well as key features that are included in the discussion below. These features include the EBV Incinerator Building, Buildings #1 and #3, proposed Building #11,¹ the Stormwater and Sanitary Ponds, the North Ditch, and the North Wetlands Ditch.

Figures 2 and 3 show the spatial distribution over time of perchlorate and RDX historic data in the North Wetlands Ditch. Seven overburden monitoring wells are located adjacent to EBV along the North Wetlands Ditch. This figure includes monitoring wells MW-9, MW-27, MW-32, MW-76, MW-127, MW-137, and MW-143. In addition to these overburden wells, a three-well cluster is located downgradient of EBV, along the North Wetlands Ditch. This well cluster consists of overburden residual monitoring well MW-82 (screened interval 28.42'-38.02'), residual well MW-81 (screened interval 43.03'-52.63') and bedrock well MW-83 (screened interval 97.04'-102.04').

EMI offers the following response to both your letter and to items included in the attached Conference Record:

Comment: Testing EMI's monitoring wells with increased perchlorate concentrations for the complementary compound or element that form perchlorate salts such as ammonium (NH₄), calcium (Ca), sodium (Na), and/or potassium (K), to determine if the source of the perchlorate contamination could be traced back to a specific source. Each of these elements or compounds is associated with a perchlorate energetic compound.

Response: EMI has reviewed the latest groundwater and surface water data gathered during the 2013 Groundwater/Surface Water sampling event. A total of ten monitoring wells from the area were selected for the Mann-Kendall statistical analysis (see **Figures 2 and 3**) to determine if trends in groundwater concentrations can be determined. Monitoring wells were selected based on their proximity to the locations exhibiting increasing trends. This analysis included upgradient and downgradient monitoring wells located along both sides of the North Wetlands Ditch. Of these, nine wells had an adequate number of data points (>4) for perchlorate concentrations. Enclosed with this letter is a memorandum regarding *Mann-Kendall Calculations with Statistical Analysis for Selected Wells near the General Dynamics Property*, prepared by RBR Consulting, Inc. that provides detailed information regarding this analysis.

Generally, the analysis shows that perchlorate concentrations in several key wells located **downgradient** from EBV continue to increase while all other perchlorate concentrations across the EMI site remained consistent with historic data. Increasing trends were identified at MW-27, MW-76, and MW-82. Notably, MW-32, MW-81, and MW-82, located immediately downgradient of EBV, had their highest reported concentrations to date. MW-76 was dry and could not be sampled during the 2013 annual event; however, an increasing trend was identified at this location in 2012. MW-127 has a decreasing perchlorate trend, while MW-143 has remained stable with negligible change. Both of these wells are located across the North Wetlands Ditch to the south of EBV. Bedrock well MW-83 (part of a well cluster with

¹ We understand the proposed Building #11 will be built at the location of the current stormwater retention pond. This likely will result in added stormwater runoff from EBV's facility.

MW-81 and MW-82) had "No Trend" with only trace detections of perchlorate, indicating that perchlorate has not migrated to the bedrock aquifer in the North Wetlands Ditch.

It also is worth noting that a possible connection between the increasing perchlorate trends and trends in RDX concentrations was observed. Specifically, where perchlorate concentrations were increasing, RDX concentrations followed suit. EMI understands that in addition to the significant quantities of perchlorate being handled on the EBV property, M42/M46/M77 submunitions from Class 1.1 D military munitions are demilitarized in Building #1. RDX is commonly used in submunitions located in the warhead of the MLRS rocket. This constituent is also a good potential groundwater tracer, and one for which we have a large amount of historic sampling data from many sampling points across the EMI Facility. We recommend EBV add this analyte, and any other constituents found in the MLRS rocket and/or warhead, as well as any other constituents handled by EBV, to any supplemental sampling proposed for perchlorate salts analysis. However, it must be emphasized that the proposed additional analysis will not close the obvious data gap and need for additional upgradient monitoring points on EBV property to the north and northwest of MW-32.

The apparent connection between perchlorate and RDX in this area was evident in several monitoring wells located along the North Wetlands Ditch, including MW-27, MW-76, and MW-82, each of which show increasing trends in both perchlorate and RDX concentration with a 90% confidence level. "No Trend" could be determined for either compound at MW-32; however, perchlorate concentrations have shown significant increases since sampling began in 2011 while RDX concentrations have fluctuated over the past three years. RDX had not previously been detected at this location, but MW-32 was not part of the annual sampling program from 2001 to 2010. RDX has an increasing trend at MW-137, while perchlorate has no trend at this location.

Comment: *Gathering data from previous years for the other wells located near the North Wetlands Ditch (MW-53, MW-67, MW-68) to look for undiscovered source(s), unidentified residue, or an undocumented spill event and for other chemicals in the ditch area.*

Response: There is no evidence, based both on EMI's extensive knowledge of historic operations at its facility and extensive sampling and monitoring data at the EMI facility, that a perchlorate source exists to the southwest of EBV's property. Perchlorate concentrations from the most recent sampling event in 2012 at MW-53 revealed only trace concentrations of perchlorate (0.47 ppb), while RDX at that location was not detected. Although MW-67 and MW-68 have not been sampled for perchlorate based on the fact that no activities occurred in that area involving use or storage of perchlorate, MW-127 and MW-143 are located in the North Wetlands Ditch down- or cross-gradient of these three identified monitoring wells – as well as down- or cross-gradient of the TNT production line and ammonium nitrate manufacturing areas. MW-127 and MW-143 have shown low and decreasing perchlorate concentrations and non-detectable concentrations of RDX since 2002. MW-127 is expected to intercept any contaminants in groundwater originating in to the west/southwest of North

Wetlands Ditch. This data does not support a perchlorate source to the west or southwest of the North Wetlands Ditch.

Comment: *Inspecting and investigating the water supply piping buried underground at EBV to determine if the system is leaking and may be a driving force for the increasing perchlorate contamination in the EMI wells.*

Response: The source of the increase in perchlorate and RDX concentrations observed in the wells along the North Wetland Ditch may or may not be constant and concentrations may be dependent on the processes occurring at the EBV facility at the time of the sampling event; therefore, more frequent monitoring of these locations may be required. We also recommend that EBV investigate the source of the water reportedly flowing intermittently from a pipe into a ditch across the EMI property near the North Wetlands Extension.

Comment: *Mr. Zoghby explained that the propellant which contains ammonium perchlorate is treated in building #3 and the building is well-sealed to avoid leakage of any spills. In addition, Mr. Zoghby stated that there have not been any recorded spills of ammonium perchlorate inside or outside of building #3.*

Building #3 is located at the Northwest corner of the EBV facility, which is on the other side of the facility across a ridge from the EMI wells with the increasing perchlorate contamination. Based on a review of EMI's groundwater contour map, Mr. Zoghby indicated that it seems unlikely that the groundwater would go uphill across the ridge to be able to migrate to the EMI wells located at the Southeast corner of EBV property.

Response: While Building #3 is an obvious potential source of Perchlorate, it is apparent that perchlorate is handled at other locations and may be present in multiple processes and waste streams throughout the EBV facility. Other potential sources of perchlorate at the EBV facility include dumpsters where the scrap metal from bodies and warheads of the MLRS rockets are staged onsite pending recycling, any potential spills from drums of concentrated perchlorate wastewater during transport for disposal at the incinerator complex, storm water runoff, or other possible underground piping locations. EBV indicates that the wastewater generated in Building #3 is transported across the site to the incinerator creating a potential pathway for contaminants in other portions of the site. From the point of generation to the point of disposal, opportunities for a release exist. Also enclosed with this letter are aerial photos of the EBV facility, which clearly show additional possible sources of contamination, including evidence of surface run-off from both Building #3 and the stormwater pond, as well as stressed vegetation by the incinerator and numerous roll-off boxes.

Although more recent groundwater elevation data is not available from the EBV property, former monitoring wells MW-31 and MW-33 were previously located in the area of the incinerator building. Groundwater contour maps produced prior to the abandonment of MW-31 and MW-33 confirm the direction of groundwater flow in the overburden aquifer moves from EBV toward MW-32 and ultimately the North Wetlands Ditch. EBV should install monitoring wells near Building #3 to provide data useful in determining a source.

Comment: Mr. Zoghby explained the rocket motors containing the ammonium perchlorate based propellant are treated within building #3 using the following processes. The rocket motors are cut into 8 to 10 segments or slices about 1 foot in length using an underwater saw in a water tank. The propellant in each segment is then ignited in a Propellant Thermal Treatment Chamber by a natural gas fired torch and burned. The water from the underwater saws is reused until the concentration of perchlorate exceeds 8%. The water is then removed, filtered, and put into drums, transported to building #6, and burned in the incineration complex. During this process of transporting and incinerating, no water is expected to leak since the drums are sealed in transit and introduced directly into the incinerator in a room with secondary containment with no further processing. The gases from the incinerator are treated through an air pollution control system. The flue gas enters a spray dryer that quenches the gas from 2000 °F to 350 °F and soda ash slurry is injected into the chamber. The flue gas then enters the bag house to collect soda ash and other particulates in the flue gas stream and eventually exhausted through a stack. The flue gas should have minimal amounts of perchlorate emissions after the air pollution control system and is discharged via a stack 65 meters high.

Response: Even a small volume, such as a single drum of wastewater, containing 8% (80,000,000 ppb) perchlorate have the potential to result in the concentrations of perchlorate observed in groundwater in the North Wetlands Ditch. Concentrations in the 1500 ppb range have been detected at MW-32 and similar concentrations have been detected in several other overburden monitoring wells located along the downgradient EBV property line. These concentrations continue to increase above the GPS of 18 ppb. Increasing trends have been identified using Mann-Kendall statistical analysis with a 90% probability level at MW-27, MW-76, and MW-82 (see **Figure 2**). We also refer MDNR to the enclosed aerial photos of the EBV facility.

Comment: During the discussion, Mr. Zoghby mentioned that the monitoring wells are located along the North Wetlands Ditch owned by EMI and the ditch used to be a drainage area for TNT production line and an ammonium nitrate manufacturing area. Potentially, there could be an undiscovered source, unidentified residue, or an unrecorded spill event for other chemicals in the ditch area. EMI's groundwater data didn't include perchlorate concentrations for MW-53, MW-67 and MW-68, which could be helpful in resolving this issue.

Response: These wells were discussed above. Our research and EMI's knowledge of the site indicate that this scenario is highly unlikely. There is no discernable link between the TNT production line/AN manufacturing area and perchlorate in the North Wetlands Ditch. MW-53 had only trace concentrations of perchlorate during the most recent sampling event in 2012, and MW-127 and MW-143, located downgradient of MW-67 and MW-68, indicate perchlorate and RDX concentrations continue to decrease or are not detectable at these locations.

Comment: Bruce Stuart suggested that it might also be beneficial to analyze the groundwater from the EMI monitor wells for other chemicals such ammonium (NH₄), calcium (Ca), sodium (Na), and/or potassium (K). These results may be helpful in determining if the

perchlorate increase is resulting from the ammonium perchlorate treated by EBV or from other sources.

Response: We do not see any value to EMI conducting additional sampling outside of its permit. The more useful data would come from sampling on the EBV property for perchlorate, RDX, and any other constituents handled by EBV pursuant to EBV's corrective action obligations under its permit.

Comment: *A review of the potentiometric maps and water elevation history from EMI's sampling events was needed to determine if a change in groundwater elevations had occurred since March 2009. Since the 2012 drought it was discussed that there could also be the possibility for related soil cracking to cause groundwater infiltration into a buried or undiscovered underground perchlorate source.*

Response: Water levels have fluctuated slightly in the overburden aquifer since 2008. In 2009 they were generally higher across the site than in 2008. Water levels were generally down in 2010, but rose in 2011. In general, water level elevations were higher in 2012 than in 2011. Water levels in 2013 were very similar to those from 2012. Water level fluctuations from year to year are generally measured in inches.

Conclusions

The analytical data from EMI's wells clearly show increases in perchlorate and RDX concentrations in the North Wetlands Ditch wells downgradient of EBV. The data strongly indicates this increase is the result of a release or releases to the environment from EBV's facility sometime during the last six years. Concentrations of perchlorate at these locations have increased significantly since 2008.

In light of the multiple increasing trends in the monitoring wells located along the downgradient EBV property boundary, it is imperative that EBV test the soil and groundwater on its property to identify the source of these increasing concentrations. Without this testing on EBV's property, questions regarding the source cannot be adequately resolved. Specifically, overburden monitoring wells should be installed at multiple locations on the EBV property. Locations should include monitoring points at the Incinerator Building, Sanitary Pond, Stormwater Detention Pond, and any other locations where perchlorate waste is transported or staged, such as the rocket motor scrap metal dumpsters. Monitoring wells should also be located downgradient of Building 3.

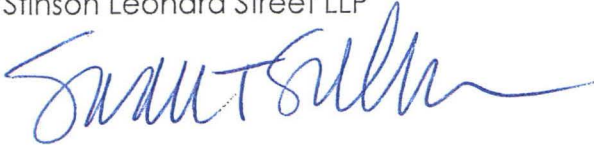
Finally, EMI has observed surface water flowing across EMI property to Grove Creek in a swale located to the north of the North Wetlands Extension. It is believed that the source of this flow originates from underground piping on EBV property. The origin of this water and piping should also be investigated and its discharge should be sampled and tested for the list of analytes discussed above.

We appreciate MDNR's attention to these important issues. Please feel free to contact me with any questions.

Mr. Jay Liu
March 21, 2014
Page 7

Best regards,

Stinson Leonard Street LLP



Sarah Toevs Sullivan

Attachments:

- RBR MK Memo – Mann-Kendall Calculations with Statistical Analysis for Selected Wells near the General Dynamics Property
- Figure 1: Partial Site Plan Area of Concentration- October 2013
- Figure 2: Perchlorate Concentrations 2009-2013 North Wetlands Ditch
- Figure 3: RDX Concentrations 2009-2013 North Wetlands Ditch
- Aerial Photos of EBV property

cc: Ken Herstowski, P.E., Project Manager, U.S. EPA Region 7 ✓
Ms. Sheila Hoover, Independent Consultant, Environmental Matters, Expert Management Inc.
Southwest Regional Office, Missouri Department of Natural Resources
Jalal El-Jayyousi, HWP-Permits Section
Bruce Stuart, HWP-Permits Section
Don Dicks, HWP-Permits Section

Risk-Based Remedies

RBR Consulting, Inc.

650 Shady Drive
Beaver Falls, PA 15010

Phone: 724-846-4096

MEMORANDUM

TO: Sarah Toevs Sullivan

CC: Mark Smith

FROM: Bruce Fishman

DATE: February 4, 2014

SUBJECT: Mann-Kendall Calculations with Statistical Analysis for Selected Wells near the General Dynamics Property
Expert Management Inc. Facility – Jasper County, Missouri

This memorandum presents the results of the Mann-Kendall analysis for selected groundwater data for the Expert Management Inc. (EMI) Facility located in Jasper County, Missouri (MOD077887909). This Mann-Kendall analysis has been conducted for groundwater data collected from the Facility between August 1993 and October 2013 from a selected number of wells. The discussion presented herein is accompanied by a table summarizing the results and the spreadsheets on which the results are based.

A total of 10 wells were selected for the Mann-Kendall analysis due to their proximity to the EBV Explosives Environmental Company dba General Dynamics Ordinance and Tactical Systems Munitions Services (General Dynamics) property. Specifically, the 10 wells (listed in Table 1) are located in the North Wetlands Ditch area, to the south/southeast of the General Dynamics property. Based on operations conducted on the General Dynamics property over the past 15 years, it is possible that increasing trends in perchlorate and RDX in groundwater in wells on the EMI Facility are due to those operations. The wells are routinely sampled as part of the groundwater monitoring programs for the EMI Facility. Of the 10 selected wells, nine wells had enough data points for perchlorate and/or RDX to perform a Mann-Kendall analysis. By performing Mann-Kendall trend analysis on these wells/constituents, potentially increasing trends can be tracked.

The analysis was conducted using the ChemStat software package Version 6.2 (Starpoint Software, March 2007). The ChemStat output files are included as Attachment A.

The ChemStat software performs the Mann-Kendall test two different ways based on the number of available data points. If there are 10 or fewer results in the data set, the software uses Gilbert (1987) Table A-18 to determine the probability of obtaining a value of "S" for n observations. If the probability value (p) obtained is greater than the specified alpha (alpha is the selected confidence interval), then one can accept the null hypothesis that there is no trend. If the value is less than the specified alpha value, or confidence level, then the test shows evidence of a trend and the null

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hypothesis should be rejected. For this analysis, an alpha of 0.1, or confidence level of 90%, was used to evaluate the percentage of certainty for the trend. For cases that had 10 or fewer observations where $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level, and the conclusion is that there is no trend in the data.

In the case that there are more than 10 observations in the data set, the normal approximation is used and a Z-score is calculated for the data set using the Mann-Kendall "S" statistic. The Z-score is compared to the percentile of the standard normal distribution for the selected confidence level (in this case a confidence level of 90% was used). If Z is greater than the percentile of the standard normal distribution, then there is evidence of a trend and the null hypothesis should be rejected. Otherwise, there is no trend. At the 90% confidence level, the percentile of the standard distribution is 1.28155. Therefore, if the absolute value of Z is less than 1.28155, the conclusion is that there is no trend in the data.

The results of the Mann-Kendall analysis for each of the 10 wells are summarized in Table 1. The individual Mann-Kendall outputs for each well/constituent combination are included as Attachment A. The results of the analysis indicate the presence of a trend as decreasing, increasing, or no trend (stable) in the concentrations of each applicable constituent in each well.

As summarized in Table 1, a total of 14 constituent evaluations were conducted using the Mann-Kendall trend analysis through the use of the ChemStat software. Of the 14 evaluations, five suggest no trend (stable), two suggest decreasing trends, and seven suggest possible increasing trends.

The seven cases of possible increasing trends are found in four of the 10 wells included in this evaluation and are discussed in more detail below.

- **MW-27 – RDX:** Analysis is based on 17 sampling events conducted between August 1993 and October 2013 with six non-detect and 11 detected results. No data were collected in 1994, from 1996 to 1998 or from 2004 to 2006. The highest concentrations of RDX were observed in October 2011 and September 2012 (44 ug/L and 42 ug/L respectively). Concentrations from the most recent sampling event in October 2013 are lower; however, variation is within the realm of sampling/analytical variability. Based on these results continued monitoring of MW-27 for RDX is recommended since additional data will further evaluate this trend. This well is located to the south of the General Dynamics property in the North Wetlands Ditch area, within Risk Assessment Area 6 (RA6).
- **MW-27 – Perchlorate:** Analysis is based on 12 sampling events conducted between November 2001 and October 2013 with all detected results. No data were collected from 2004 to 2006. The highest concentration of perchlorate (1,100 ug/L) was observed during the sampling event in 2012. This parameter has shown an increasing trend since the 2010 analysis. Concentrations observed in 2013 were slightly lower at 320 ug/L. The data may represent a true increasing trend. Based on these results, continued monitoring of MW-27 for perchlorate is recommended since additional data will further evaluate this trend. This well is located to the south of the General Dynamics property in the North Wetlands Ditch area (within RA6).

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- **MW-76 – RDX:** Analysis is based on eight sampling events with three non-detects and five detected results. No data were collected from 1996 to 1999, from 2001 to 2007, in 2010 or in 2013. The highest concentration of 46 ug/L was observed during the most recent September 2012 sampling event. Based on these results, continued monitoring of MW-76 for RDX is recommended as additional data will further evaluate this trend. This well is located to the southeast of the General Dynamics property in the North Wetlands Ditch area (within RA6).
- **MW-76 – Perchlorate:** Analysis is based on five sampling events from October 2008 to September 2012 with all detected results. No data were collected in 2010 or in 2013. The highest concentrations of perchlorate were observed in the two most recent sampling events in June and September 2012 (660 ug/L and 1,200 ug/L, respectively). This may be a true increasing trend. Based on these results, continued monitoring of MW-76 for perchlorate is recommended as additional data will further evaluate this trend. This well is located to the southeast of the General Dynamics property in the North Wetlands Ditch area (within RA6).
- **MW-82 – RDX:** Analysis is based on 17 sampling events conducted from October 1995 through October 2013 with six non-detected and 11 detected results. No data were collected from 1996 to 1998, or in 2004 or 2006. The highest concentration was observed in September 2003 with a result of 2.9 ug/L. The seven most recent concentrations are relatively consistent ranging from 0.275 ug/L to 0.625 ug/L, varying slightly from year to year. Based on these results, continued monitoring of MW-82 for RDX is recommended as additional data will further evaluate this trend. This well is located to the southeast of the General Dynamics property in the North Wetlands Ditch area (within RA6).
- **MW-82 – Perchlorate:** Analysis is based on 10 sampling events conducted from September 2003 to October 2013 with all detected results. No data were collected in 2004 or 2006. Mann-Kendall results show an increasing trend since 2010. The highest concentrations of perchlorate were detected during the four most recent sampling events in 2010, 2011, 2012 and 2013 (ranging from 9.55 ug/L to 16 ug/L). This appears to be a true increasing trend. Based on these results, continued monitoring of MW-82 for perchlorate is recommended as additional data will further evaluate this trend. This well is located to the southeast of the General Dynamics property in the North Wetlands Ditch area (within RA6).
- **MW-137 – RDX:** Analysis is based on 14 sampling events conducted from October 1995 to October 2013 with nine non-detected and five detected results. No data were collected from 1996 to 1998, in 2001, from 2004 to 2006 or in 2011. Two sampling events were conducted in 2012. The greatest concentration of 4 ug/L was observed during the October 2010 sampling event. The four latest sampling events show results ranging from 0.58 ug/L to 4 ug/L. This variation is within the realm of sampling/analytical variability. Based on these results, continued monitoring of MW-137 for RDX is recommended as additional data will further evaluate this trend. This well is located to the south of the General Dynamics property in the North Wetlands Ditch area (within RA6).

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Conclusions

Groundwater flow for the EMI Facility (and in the vicinity of the General Dynamics property) is generally eastward or northeastward toward Grove Creek, although flow direction for specific well locations is locally influenced by the ditch systems. The four wells identified above with potentially increasing trends (MW-27, MW-76, MW-82 and MW-137) are shallow wells located to the south/southeast of the General Dynamics Property. Observations of the trends for wells within the general downgradient flow direction from the General Dynamics property, in comparison to trends for wells that are upgradient or side-gradient from this property, suggests that the increasing trends for perchlorate and RDX are due to more recent operations conducted on the General Dynamics property. Continued monitoring and additional data will further evaluate these trends.

References

ChemStat User's Guide Version 6.2. (Starpoint Software, 2007). Starpoint Software. 17 March 2007.

EMI (2006) Declaration of Covenants and Restrictions. Expert Management Inc. Facility – Jasper County, Missouri (MOD077887909). March 13, 2006.

RBR Consulting, Inc. (RBR, 2013) Mann-Kendall Calculations with Statistical Analysis. February 2013.

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TABLE

TABLE 1
SUMMARY OF MANN-KENDALL ANALYSIS
Expert Management Inc. Facility - Jasper County, Missouri (MOD077887909)

Well	Constituent	Mann-Kendall Reported Trend	Z-score ¹	Probability ²	Notes
MW-09	—	—	—	—	Insufficient number of data points for both perchlorate and RDX.
MW-27	RDX	Increasing	2.39	NA	Analysis is based on 17 sampling events from 1993 to 2013; 6 ND and 11 detected results. Highest concentrations observed in 2011 and 2012. This may be a true increasing trend. Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
	Perchlorate	Increasing	2.67	NA	Analysis is based on 12 sampling events; all detected results. Highest concentration was observed during the sampling event in 2012. This parameter has shown an increasing trend since the 2010 analysis. The data may represent a true increasing trend. Continued monitoring is recommended. Additional data will further evaluate this trend.
MW-32	RDX	No Trend	NA	0.14	There is no trend. Since $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level.
	Perchlorate	No Trend	NA	0.17	There is no trend. Since $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level.
MW-76 ³	RDX	Increasing	NA	0.012	Analysis is based on 8 sampling events; 3 ND and 5 detected results. No data were collected from 1996-1999, 2001-2007 or 2013. Highest concentration observed in 2012. This may be a true increasing trend. Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
	Perchlorate	Increasing	NA	0.0083	Analysis is based on five sampling events from October 2008 to September 2012; all detected results. No data were collected in 2010. Highest concentrations were observed in the two most recent sampling events in June and September 2012. Concentrations are greater than the standard of 18 ug/L. Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
MW-81	Perchlorate	No Trend	NA	0.28	There is no trend. Since $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level.
MW-82	RDX	Increasing	1.30	NA	Analysis is based on 17 sampling events; 6 ND and 11 detected results. Highest concentration was observed in 2003. The 7 most recent concentrations are consistent (0.275 ug/L to 0.625 ug/L). Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
	Perchlorate	Increasing	NA	0.000058	Analysis is based on 10 sampling events; all detected results. Highest concentrations were observed in the four most recent sampling events. Concentrations are greater than the standard of 18 ug/L. Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
MW-83	Perchlorate	No Trend	NA	0.50	There is no trend. Since $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level.
MW-127	Perchlorate	Decreasing	NA	0.00019	The trend is decreasing at the 90% confidence level.
MW-137	RDX	Increasing	1.32	NA	Analysis is based on 14 sampling events; 9 ND and 5 detected results. Greatest concentration was observed during the 2010 sampling event. The 4 latest results show a decrease. Continued monitoring is recommended. Additional data are recommended to further evaluate this trend.
	Perchlorate	No Trend	NA	0.15	There is no trend. Since $p > 0.1$, the null hypothesis of no trend is not rejected at the 90% probability level.
MW-143	Perchlorate	Decreasing	NA	0.04	The trend is decreasing at the 90% confidence level.

Notes:

¹ When there are >10 values in a data set, a z-score is calculated and compared to the percentile of the standard normal distribution for the selected confidence interval to determine trend.

² Probability is only reported when there are 10 or fewer sampling events for a well.

³ Due to dry conditions, well was not sampled in 2013. Most recent trend is provided for reference purposes.

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ATTACHMENT A

**CHEMSTAT OUTPUT FILES FOR
MANN-KENDALL ANALYSES**

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-27

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
18.9	40.9	-22	0	1
18	40.9	-22.9	0	2
19	40.9	-21.9	0	3
21	40.9	-19.9	0	4
32	40.9	-8.9	0	5
340	40.9	299.1	1	5
520	40.9	479.1	2	5
620	40.9	579.1	3	5
170	40.9	129.1	4	5
1100	40.9	1059.1	5	5
320	40.9	279.1	6	5
18	18.9	-0.9	6	6
19	18.9	0.1	7	6
21	18.9	2.1	8	6
32	18.9	13.1	9	6
340	18.9	321.1	10	6
520	18.9	501.1	11	6
620	18.9	601.1	12	6
170	18.9	151.1	13	6
1100	18.9	1081.1	14	6
320	18.9	301.1	15	6
19	18	1	16	6
21	18	3	17	6
32	18	14	18	6
340	18	322	19	6
520	18	502	20	6
620	18	602	21	6
170	18	152	22	6
1100	18	1082	23	6
320	18	302	24	6
21	19	2	25	6
32	19	13	26	6
340	19	321	27	6
520	19	501	28	6
620	19	601	29	6
170	19	151	30	6
1100	19	1081	31	6
320	19	301	32	6
32	21	11	33	6
340	21	319	34	6
520	21	499	35	6
620	21	599	36	6
170	21	149	37	6
1100	21	1079	38	6
320	21	299	39	6
340	32	308	40	6
520	32	488	41	6
620	32	588	42	6
170	32	138	43	6
1100	32	1068	44	6
320	32	288	45	6
520	340	180	46	6
620	340	280	47	6
170	340	-170	47	7
1100	340	760	48	7

320	340	-20	48	8
620	520	100	49	8
170	520	-350	49	9
1100	520	580	50	9
320	520	-200	50	10
170	620	-450	50	11
1100	620	480	51	11
320	620	-300	51	12
1100	170	930	52	12
320	170	150	53	12
320	1100	-780	53	13

S Statistic = 53 - 13 = 40

Tied Group	Value	Members
Time Period		Observations
11/7/2001		1
6/19/2002		1
9/17/2003		1
10/18/2007		1
10/10/2008		1
10/15/2009		1
10/4/2010		1
11/18/2010		1
10/17/2011		1
6/7/2012		1
9/24/2012		1
10/8/2013		1
There are 0 time periods with multiple data		

A = 0

B = 0

C = 0

D = 0

E = 0

F = 0

a = 3828

b = 11880

c = 264

Group Variance = 212.667

Z-Score = 2.67433

Comparison Level at 90% confidence level = 1.28155 (upward trend)

2.67433 > 1.28155 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: RDX

Location: MW-27

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<4.2	ND<8.4	-4.2	0	1
2.6	ND<8.4	-5.8	0	2
ND<0.5	ND<8.4	-7.9	0	3
ND<2.5	ND<8.4	-5.9	0	4
ND<1.85	ND<8.4	-6.55	0	5
2.6	ND<8.4	-5.8	0	6
6.7	ND<8.4	-1.7	0	7
ND<1.2	ND<8.4	-7.2	0	8
1.9	ND<8.4	-6.5	0	9
3	ND<8.4	-5.4	0	10
7.7	ND<8.4	-0.7	0	11
11	ND<8.4	2.6	1	11
44	ND<8.4	35.6	2	11
22	ND<8.4	13.6	3	11
42	ND<8.4	33.6	4	11
17	ND<8.4	8.6	5	11
2.6	ND<4.2	-1.6	5	12
ND<0.5	ND<4.2	-3.7	5	13
ND<2.5	ND<4.2	-1.7	5	14
ND<1.85	ND<4.2	-2.35	5	15
2.6	ND<4.2	-1.6	5	16
6.7	ND<4.2	2.5	6	16
ND<1.2	ND<4.2	-3	6	17
1.9	ND<4.2	-2.3	6	18
3	ND<4.2	-1.2	6	19
7.7	ND<4.2	3.5	7	19
11	ND<4.2	6.8	8	19
44	ND<4.2	39.8	9	19
22	ND<4.2	17.8	10	19
42	ND<4.2	37.8	11	19
17	ND<4.2	12.8	12	19
ND<0.5	2.6	-2.1	12	20
ND<2.5	2.6	-0.1	12	21
ND<1.85	2.6	-0.75	12	22
2.6	2.6	0	12	22
6.7	2.6	4.1	13	22
ND<1.2	2.6	-1.4	13	23
1.9	2.6	-0.7	13	24
3	2.6	0.4	14	24
7.7	2.6	5.1	15	24
11	2.6	8.4	16	24
44	2.6	41.4	17	24
22	2.6	19.4	18	24
42	2.6	39.4	19	24
17	2.6	14.4	20	24
ND<2.5	ND<0.5	2	21	24
ND<1.85	ND<0.5	1.35	22	24
2.6	ND<0.5	2.1	23	24
6.7	ND<0.5	6.2	24	24
ND<1.2	ND<0.5	0.7	25	24
1.9	ND<0.5	1.4	26	24
3	ND<0.5	2.5	27	24
7.7	ND<0.5	7.2	28	24
11	ND<0.5	10.5	29	24
44	ND<0.5	43.5	30	24
22	ND<0.5	21.5	31	24
42	ND<0.5	41.5	32	24
17	ND<0.5	16.5	33	24
ND<1.85	ND<2.5	-0.65	33	25
2.6	ND<2.5	0.1	34	25
6.7	ND<2.5	4.2	35	25
ND<1.2	ND<2.5	-1.3	35	26
1.9	ND<2.5	-0.6	35	27
3	ND<2.5	0.5	36	27
7.7	ND<2.5	5.2	37	27

11	ND<2.5	8.5	38	27
44	ND<2.5	41.5	39	27
22	ND<2.5	19.5	40	27
42	ND<2.5	39.5	41	27
17	ND<2.5	14.5	42	27
2.6	ND<1.85	0.75	43	27
6.7	ND<1.85	4.85	44	27
ND<1.2	ND<1.85	-0.65	44	28
1.9	ND<1.85	0.05	45	28
3	ND<1.85	1.15	46	28
7.7	ND<1.85	5.85	47	28
11	ND<1.85	9.15	48	28
44	ND<1.85	42.15	49	28
22	ND<1.85	20.15	50	28
42	ND<1.85	40.15	51	28
17	ND<1.85	15.15	52	28
6.7	2.6	4.1	53	28
ND<1.2	2.6	-1.4	53	29
1.9	2.6	-0.7	53	30
3	2.6	0.4	54	30
7.7	2.6	5.1	55	30
11	2.6	8.4	56	30
44	2.6	41.4	57	30
22	2.6	19.4	58	30
42	2.6	39.4	59	30
17	2.6	14.4	60	30
ND<1.2	6.7	-5.5	60	31
1.9	6.7	-4.8	60	32
3	6.7	-3.7	60	33
7.7	6.7	1	61	33
11	6.7	4.3	62	33
44	6.7	37.3	63	33
22	6.7	15.3	64	33
42	6.7	35.3	65	33
17	6.7	10.3	66	33
1.9	ND<1.2	0.7	67	33
3	ND<1.2	1.8	68	33
7.7	ND<1.2	6.5	69	33
11	ND<1.2	9.8	70	33
44	ND<1.2	42.8	71	33
22	ND<1.2	20.8	72	33
42	ND<1.2	40.8	73	33
17	ND<1.2	15.8	74	33
3	1.9	1.1	75	33
7.7	1.9	5.8	76	33
11	1.9	9.1	77	33
44	1.9	42.1	78	33
22	1.9	20.1	79	33
42	1.9	40.1	80	33
17	1.9	15.1	81	33
7.7	3	4.7	82	33
11	3	8	83	33
44	3	41	84	33
22	3	19	85	33
42	3	39	86	33
17	3	14	87	33
11	7.7	3.3	88	33
44	7.7	36.3	89	33
22	7.7	14.3	90	33
42	7.7	34.3	91	33
17	7.7	9.3	92	33
44	11	33	93	33
22	11	11	94	33
42	11	31	95	33
17	11	6	96	33
22	44	-22	96	34
42	44	-2	96	35
17	44	-27	96	36
42	22	20	97	36

17	22	-5	97	37
17	42	-25	97	38

S Statistic = 97 - 38 = 59

Tied Group	Value	Members
1	2.6	2

Time Period	Observations
8/19/1993	1
7/20/1995	1
11/16/1999	1
2/23/2000	1
6/7/2000	1
9/14/2000	1
11/7/2001	1
6/19/2002	1
9/17/2003	1
10/18/2007	1
10/10/2008	1
10/15/2009	1
10/4/2010	1
10/17/2011	1
6/7/2012	1
9/24/2012	1
10/8/2013	1

There are 0 time periods with multiple data

A = 18
 B = 0
 C = 0
 D = 0
 E = 2
 F = 0
 a = 10608
 b = 36720
 c = 544
 Group Variance = 588.333
 Z-Score = 2.3912
 Comparison Level at 90% confidence level = 1.28155 (upward trend)
2.3912 > 1.28155 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-32

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
1500	760	740	1	0
770	760	10	2	0
2000	760	1240	3	0
770	1500	-730	3	1
2000	1500	500	4	1
2000	770	1230	5	1

S Statistic = 5 - 1 = 4

Comparing at 90% confidence level (upward trend)

Probability of obtaining $S \geq 4$ is 0.167

$S < 0$ or $0.167 \geq 0.1$ indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: RDX

Location: MW-32

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0.25	ND<0.84	-0.59	0	1
0.505	ND<0.84	-0.335	0	2
31	ND<0.84	30.16	1	2
63	ND<0.84	62.16	2	2
20	ND<0.84	19.16	3	2
0.505	ND<0.25	0.255	4	2
31	ND<0.25	30.75	5	2
63	ND<0.25	62.75	6	2
20	ND<0.25	19.75	7	2
31	0.505	30.495	8	2
63	0.505	62.495	9	2
20	0.505	19.495	10	2
63	31	32	11	2
20	31	-11	11	3
20	63	-43	11	4

S Statistic = 11 - 4 = 7

Comparing at 90% confidence level (upward trend)

Probability of obtaining S >= 7 is 0.136

S < 0 or 0.136 >= 0.1 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-76

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
120	76	44	1	0
260	76	184	2	0
660	76	584	3	0
1200	76	1124	4	0
260	120	140	5	0
660	120	540	6	0
1200	120	1080	7	0
660	260	400	8	0
1200	260	940	9	0
1200	660	540	10	0

S Statistic = 10 - 0 = 10

Comparing at 90% confidence level (upward trend)

Probability of obtaining $S \geq 10$ is 0.0083

S > 0 and 0.0083 < 0.1 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: RDX

Location: MW-76

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0.25	ND<0.84	-0.59	0	1
ND<0.25	ND<0.84	-0.59	0	2
7.7	ND<0.84	6.86	1	2
34	ND<0.84	33.16	2	2
11	ND<0.84	10.16	3	2
24	ND<0.84	23.16	4	2
46	ND<0.84	45.16	5	2
ND<0.25	ND<0.25	0	5	2
7.7	ND<0.25	7.45	6	2
34	ND<0.25	33.75	7	2
11	ND<0.25	10.75	8	2
24	ND<0.25	23.75	9	2
46	ND<0.25	45.75	10	2
7.7	ND<0.25	7.45	11	2
34	ND<0.25	33.75	12	2
11	ND<0.25	10.75	13	2
24	ND<0.25	23.75	14	2
46	ND<0.25	45.75	15	2
34	7.7	26.3	16	2
11	7.7	3.3	17	2
24	7.7	16.3	18	2
46	7.7	38.3	19	2
11	34	-23	19	3
24	34	-10	19	4
46	34	12	20	4
24	11	13	21	4
46	11	35	22	4
46	24	22	23	4

S Statistic = 23 - 4 = 19

Comparing at 90% confidence level (upward trend)

Probability of obtaining S >= 19 is 0.01155

S > 0 and 0.01155 < 0.1 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-81

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
0.61	15	-14.39	0	1
0.73	15	-14.27	0	2
0.44	15	-14.56	0	3
0.52	15	-14.48	0	4
0.5	15	-14.5	0	5
2.4	15	-12.6	0	6
0.73	0.61	0.12	1	6
0.44	0.61	-0.17	1	7
0.52	0.61	-0.09	1	8
0.5	0.61	-0.11	1	9
2.4	0.61	1.79	2	9
0.44	0.73	-0.29	2	10
0.52	0.73	-0.21	2	11
0.5	0.73	-0.23	2	12
2.4	0.73	1.67	3	12
0.52	0.44	0.08	4	12
0.5	0.44	0.06	5	12
2.4	0.44	1.96	6	12
0.5	0.52	-0.02	6	13
2.4	0.52	1.88	7	13
2.4	0.5	1.9	8	13

S Statistic = 8 - 13 = -5

Comparing at 90% confidence level (upward trend)

Probability of obtaining $S \geq -5$ is 0.281

$S < 0$ or $0.281 \geq 0.1$ indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-82

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
5.9	6.1	-0.2	0	1
6.9	6.1	0.8	1	1
6.15	6.1	0.05	2	1
8.05	6.1	1.95	3	1
9.4	6.1	3.3	4	1
9.8	6.1	3.7	5	1
9.55	6.1	3.45	6	1
11	6.1	4.9	7	1
16	6.1	9.9	8	1
6.9	5.9	1	9	1
6.15	5.9	0.25	10	1
8.05	5.9	2.15	11	1
9.4	5.9	3.5	12	1
9.8	5.9	3.9	13	1
9.55	5.9	3.65	14	1
11	5.9	5.1	15	1
16	5.9	10.1	16	1
6.15	6.9	-0.75	16	2
8.05	6.9	1.15	17	2
9.4	6.9	2.5	18	2
9.8	6.9	2.9	19	2
9.55	6.9	2.65	20	2
11	6.9	4.1	21	2
16	6.9	9.1	22	2
8.05	6.15	1.9	23	2
9.4	6.15	3.25	24	2
9.8	6.15	3.65	25	2
9.55	6.15	3.4	26	2
11	6.15	4.85	27	2
16	6.15	9.85	28	2
9.4	8.05	1.35	29	2
9.8	8.05	1.75	30	2
9.55	8.05	1.5	31	2
11	8.05	2.95	32	2
16	8.05	7.95	33	2
9.8	9.4	0.4	34	2
9.55	9.4	0.15	35	2
11	9.4	1.6	36	2
16	9.4	6.6	37	2
9.55	9.8	-0.25	37	3
11	9.8	1.2	38	3
16	9.8	6.2	39	3
11	9.55	1.45	40	3
16	9.55	6.45	41	3
16	11	5	42	3

S Statistic = 42 - 3 = 39

Comparing at 90% confidence level (upward trend)

Probability of obtaining S >= 39 is 5.8e-005

S > 0 and 5.8e-005 < 0.1 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: RDX

Location: MW-82

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0.25	0.84	-0.59	0	1
ND<0.25	0.84	-0.59	0	2
ND<0.25	0.84	-0.59	0	3
ND<0.25	0.84	-0.59	0	4
ND<0.25	0.84	-0.59	0	5
0.175	0.84	-0.665	0	6
2.9	0.84	2.06	1	6
1.7	0.84	0.86	2	6
ND<2	0.84	1.16	3	6
0.625	0.84	-0.215	3	7
0.275	0.84	-0.565	3	8
0.31	0.84	-0.53	3	9
0.37	0.84	-0.47	3	10
0.43	0.84	-0.41	3	11
0.57	0.84	-0.27	3	12
0.6	0.84	-0.24	3	13
ND<0.25	ND<0.25	0	3	13
ND<0.25	ND<0.25	0	3	13
ND<0.25	ND<0.25	0	3	13
ND<0.25	ND<0.25	0	3	13
0.175	ND<0.25	-0.075	3	14
2.9	ND<0.25	2.65	4	14
1.7	ND<0.25	1.45	5	14
ND<2	ND<0.25	1.75	6	14
0.625	ND<0.25	0.375	7	14
0.275	ND<0.25	0.025	8	14
0.31	ND<0.25	0.06	9	14
0.37	ND<0.25	0.12	10	14
0.43	ND<0.25	0.18	11	14
0.57	ND<0.25	0.32	12	14
0.6	ND<0.25	0.35	13	14
ND<0.25	ND<0.25	0	13	14
ND<0.25	ND<0.25	0	13	14
ND<0.25	ND<0.25	0	13	14
0.175	ND<0.25	-0.075	13	15
2.9	ND<0.25	2.65	14	15
1.7	ND<0.25	1.45	15	15
ND<2	ND<0.25	1.75	16	15
0.625	ND<0.25	0.375	17	15
0.275	ND<0.25	0.025	18	15
0.31	ND<0.25	0.06	19	15
0.37	ND<0.25	0.12	20	15
0.43	ND<0.25	0.18	21	15
0.57	ND<0.25	0.32	22	15
0.6	ND<0.25	0.35	23	15
ND<0.25	ND<0.25	0	23	15
ND<0.25	ND<0.25	0	23	15
0.175	ND<0.25	-0.075	23	16
2.9	ND<0.25	2.65	24	16
1.7	ND<0.25	1.45	25	16
ND<2	ND<0.25	1.75	26	16
0.625	ND<0.25	0.375	27	16
0.275	ND<0.25	0.025	28	16
0.31	ND<0.25	0.06	29	16
0.37	ND<0.25	0.12	30	16
0.43	ND<0.25	0.18	31	16
0.57	ND<0.25	0.32	32	16
0.6	ND<0.25	0.35	33	16
ND<0.25	ND<0.25	0	33	16
0.175	ND<0.25	-0.075	33	17
2.9	ND<0.25	2.65	34	17
1.7	ND<0.25	1.45	35	17
ND<2	ND<0.25	1.75	36	17
0.625	ND<0.25	0.375	37	17
0.275	ND<0.25	0.025	38	17

0.31	ND<0.25	0.06	39	17
0.37	ND<0.25	0.12	40	17
0.43	ND<0.25	0.18	41	17
0.57	ND<0.25	0.32	42	17
0.6	ND<0.25	0.35	43	17
0.175	ND<0.25	-0.075	43	18
2.9	ND<0.25	2.65	44	18
1.7	ND<0.25	1.45	45	18
ND<2	ND<0.25	1.75	46	18
0.625	ND<0.25	0.375	47	18
0.275	ND<0.25	0.025	48	18
0.31	ND<0.25	0.06	49	18
0.37	ND<0.25	0.12	50	18
0.43	ND<0.25	0.18	51	18
0.57	ND<0.25	0.32	52	18
0.6	ND<0.25	0.35	53	18
2.9	0.175	2.725	54	18
1.7	0.175	1.525	55	18
ND<2	0.175	1.825	56	18
0.625	0.175	0.45	57	18
0.275	0.175	0.1	58	18
0.31	0.175	0.135	59	18
0.37	0.175	0.195	60	18
0.43	0.175	0.255	61	18
0.57	0.175	0.395	62	18
0.6	0.175	0.425	63	18
1.7	2.9	-1.2	63	19
ND<2	2.9	-0.9	63	20
0.625	2.9	-2.275	63	21
0.275	2.9	-2.625	63	22
0.31	2.9	-2.59	63	23
0.37	2.9	-2.53	63	24
0.43	2.9	-2.47	63	25
0.57	2.9	-2.33	63	26
0.6	2.9	-2.3	63	27
ND<2	1.7	0.3	64	27
0.625	1.7	-1.075	64	28
0.275	1.7	-1.425	64	29
0.31	1.7	-1.39	64	30
0.37	1.7	-1.33	64	31
0.43	1.7	-1.27	64	32
0.57	1.7	-1.13	64	33
0.6	1.7	-1.1	64	34
0.625	ND<2	-1.375	64	35
0.275	ND<2	-1.725	64	36
0.31	ND<2	-1.69	64	37
0.37	ND<2	-1.63	64	38
0.43	ND<2	-1.57	64	39
0.57	ND<2	-1.43	64	40
0.6	ND<2	-1.4	64	41
0.275	0.625	-0.35	64	42
0.31	0.625	-0.315	64	43
0.37	0.625	-0.255	64	44
0.43	0.625	-0.195	64	45
0.57	0.625	-0.055	64	46
0.6	0.625	-0.025	64	47
0.31	0.275	0.035	65	47
0.37	0.275	0.095	66	47
0.43	0.275	0.155	67	47
0.57	0.275	0.295	68	47
0.6	0.275	0.325	69	47
0.37	0.31	0.06	70	47
0.43	0.31	0.12	71	47
0.57	0.31	0.26	72	47
0.6	0.31	0.29	73	47
0.43	0.37	0.06	74	47
0.57	0.37	0.2	75	47
0.6	0.37	0.23	76	47
0.57	0.43	0.14	77	47

0.6	0.43	0.17	78	47
0.6	0.57	0.03	79	47

S Statistic = 79 - 47 = 32

Tied Group	Value	Members
1	0.25	5

Time Period	Observations
10/24/1995	1
11/3/1999	1
2/23/2000	1
6/7/2000	1
9/20/2000	1
11/6/2001	1
6/14/2002	1
9/17/2003	1
10/5/2005	1
10/16/2007	1
10/9/2008	1
10/19/2009	1
9/30/2010	1
10/18/2011	1
6/18/2012	1
9/20/2012	1
10/7/2013	1

There are 0 time periods with multiple data

A = 300
 B = 0
 C = 60
 D = 0
 E = 20
 F = 0
 a = 10608
 b = 36720
 c = 544
 Group Variance = 572.667
 Z-Score = 1.29542
 Comparison Level at 90% confidence level = 1.28155 (upward trend)
1.29542 > 1.28155 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-83

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
0.5	0.51	-0.01	0	1
0.475	0.51	-0.035	0	2
0.47	0.51	-0.04	0	3
0.49	0.51	-0.02	0	4
0.56	0.51	0.05	1	4
0.475	0.5	-0.025	1	5
0.47	0.5	-0.03	1	6
0.49	0.5	-0.01	1	7
0.56	0.5	0.06	2	7
0.47	0.475	-0.005	2	8
0.49	0.475	0.015	3	8
0.56	0.475	0.085	4	8
0.49	0.47	0.02	5	8
0.56	0.47	0.09	6	8
0.56	0.49	0.07	7	8

S Statistic = 7 - 8 = -1

Comparing at 90% confidence level (upward trend)

Probability of obtaining $S \geq -1$ is 0.5

$S < 0$ or $0.5 \geq 0.1$ indicating no evidence of an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-127

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
9	16	-7	0	1
8.9	16	-7.1	0	2
6.9	16	-9.1	0	3
5.3	16	-10.7	0	4
4.4	16	-11.6	0	5
5	16	-11	0	6
4.3	16	-11.7	0	7
8.9	9	-0.1	0	8
6.9	9	-2.1	0	9
5.3	9	-3.7	0	10
4.4	9	-4.6	0	11
5	9	-4	0	12
4.3	9	-4.7	0	13
6.9	8.9	-2	0	14
5.3	8.9	-3.6	0	15
4.4	8.9	-4.5	0	16
5	8.9	-3.9	0	17
4.3	8.9	-4.6	0	18
5.3	6.9	-1.6	0	19
4.4	6.9	-2.5	0	20
5	6.9	-1.9	0	21
4.3	6.9	-2.6	0	22
4.4	5.3	-0.9	0	23
5	5.3	-0.3	0	24
4.3	5.3	-1	0	25
5	4.4	0.6	1	25
4.3	4.4	-0.1	1	26
4.3	5	-0.7	1	27

S Statistic = 1 - 27 = -26

Comparing at 90% confidence level (downward trend)

Probability of obtaining S >= 26 is 0.00019

S < 0 and 0.00019 < 0.1 indicating a downward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-137

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
28	22.4	5.6	1	0
15	22.4	-7.4	1	1
7.6	22.4	-14.8	1	2
13	22.4	-9.4	1	3
73	22.4	50.6	2	3
390	22.4	367.6	3	3
8.6	22.4	-13.8	3	4
90	22.4	67.6	4	4
290	22.4	267.6	5	4
15	28	-13	5	5
7.6	28	-20.4	5	6
13	28	-15	5	7
73	28	45	6	7
390	28	362	7	7
8.6	28	-19.4	7	8
90	28	62	8	8
290	28	262	9	8
7.6	15	-7.4	9	9
13	15	-2	9	10
73	15	58	10	10
390	15	375	11	10
8.6	15	-6.4	11	11
90	15	75	12	11
290	15	275	13	11
13	7.6	5.4	14	11
73	7.6	65.4	15	11
390	7.6	382.4	16	11
8.6	7.6	1	17	11
90	7.6	82.4	18	11
290	7.6	282.4	19	11
73	13	60	20	11
390	13	377	21	11
8.6	13	-4.4	21	12
90	13	77	22	12
290	13	277	23	12
390	73	317	24	12
8.6	73	-64.4	24	13
90	73	17	25	13
290	73	217	26	13
8.6	390	-381.4	26	14
90	390	-300	26	15
290	390	-100	26	16
90	8.6	81.4	27	16
290	8.6	281.4	28	16
290	90	200	29	16

S Statistic = 29 - 16 = 13

Comparing at 90% confidence level (upward trend)

Probability of obtaining S >= 13 is 0.146

S < 0 or 0.146 >= 0.1 indicating no evidence of an upward trend

Mann-Kendall Trend Analysis
Parameter: RDX
Location: MW-137
Original Data (Not Transformed)
Non-Detects Replaced with Detection Limit

90% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
ND<0.25	ND<0.84	-0.59	0	1
ND<0.25	ND<0.84	-0.59	0	2
ND<0.25	ND<0.84	-0.59	0	3
ND<0.25	ND<0.84	-0.59	0	4
ND<0.25	ND<0.84	-0.59	0	5
ND<0.25	ND<0.84	-0.59	0	6
ND<5	ND<0.84	4.16	1	6
0.087	ND<0.84	-0.753	1	7
ND<2	ND<0.84	1.16	2	7
4	ND<0.84	3.16	3	7
0.58	ND<0.84	-0.26	3	8
2.8	ND<0.84	1.96	4	8
1.55	ND<0.84	0.71	5	8
ND<0.25	ND<0.25	0	5	8
ND<0.25	ND<0.25	0	5	8
ND<0.25	ND<0.25	0	5	8
ND<0.25	ND<0.25	0	5	8
ND<0.25	ND<0.25	0	5	8
ND<5	ND<0.25	4.75	6	8
0.087	ND<0.25	-0.163	6	9
ND<2	ND<0.25	1.75	7	9
4	ND<0.25	3.75	8	9
0.58	ND<0.25	0.33	9	9
2.8	ND<0.25	2.55	10	9
1.55	ND<0.25	1.3	11	9
ND<0.25	ND<0.25	0	11	9
ND<0.25	ND<0.25	0	11	9
ND<0.25	ND<0.25	0	11	9
ND<0.25	ND<0.25	0	11	9
ND<5	ND<0.25	4.75	12	9
0.087	ND<0.25	-0.163	12	10
ND<2	ND<0.25	1.75	13	10
4	ND<0.25	3.75	14	10
0.58	ND<0.25	0.33	15	10
2.8	ND<0.25	2.55	16	10
1.55	ND<0.25	1.3	17	10
ND<0.25	ND<0.25	0	17	10
ND<0.25	ND<0.25	0	17	10
ND<0.25	ND<0.25	0	17	10
ND<5	ND<0.25	4.75	18	10
0.087	ND<0.25	-0.163	18	11
ND<2	ND<0.25	1.75	19	11
4	ND<0.25	3.75	20	11
0.58	ND<0.25	0.33	21	11
2.8	ND<0.25	2.55	22	11
1.55	ND<0.25	1.3	23	11
ND<0.25	ND<0.25	0	23	11
ND<0.25	ND<0.25	0	23	11
ND<5	ND<0.25	4.75	24	11
0.087	ND<0.25	-0.163	24	12
ND<2	ND<0.25	1.75	25	12
4	ND<0.25	3.75	26	12
0.58	ND<0.25	0.33	27	12
2.8	ND<0.25	2.55	28	12
1.55	ND<0.25	1.3	29	12
ND<0.25	ND<0.25	0	29	12
ND<5	ND<0.25	4.75	30	12
0.087	ND<0.25	-0.163	30	13
ND<2	ND<0.25	1.75	31	13
4	ND<0.25	3.75	32	13
0.58	ND<0.25	0.33	33	13
2.8	ND<0.25	2.55	34	13
1.55	ND<0.25	1.3	35	13

ND<5	ND<0.25	4.75	36	13
0.087	ND<0.25	-0.163	36	14
ND<2	ND<0.25	1.75	37	14
4	ND<0.25	3.75	38	14
0.58	ND<0.25	0.33	39	14
2.8	ND<0.25	2.55	40	14
1.55	ND<0.25	1.3	41	14
0.087	ND<5	-4.913	41	15
ND<2	ND<5	-3	41	16
4	ND<5	-1	41	17
0.58	ND<5	-4.42	41	18
2.8	ND<5	-2.2	41	19
1.55	ND<5	-3.45	41	20
ND<2	0.087	1.913	42	20
4	0.087	3.913	43	20
0.58	0.087	0.493	44	20
2.8	0.087	2.713	45	20
1.55	0.087	1.463	46	20
4	ND<2	2	47	20
0.58	ND<2	-1.42	47	21
2.8	ND<2	0.8	48	21
1.55	ND<2	-0.45	48	22
0.58	4	-3.42	48	23
2.8	4	-1.2	48	24
1.55	4	-2.45	48	25
2.8	0.58	2.22	49	25
1.55	0.58	0.97	50	25
1.55	2.8	-1.25	50	26

S Statistic = 50 - 26 = 24

Tied Group	Value	Members
1	0.25	6

Time Period	Observations
10/24/1995	1
11/16/1999	1
2/23/2000	1
6/7/2000	1
9/15/2000	1
6/19/2002	1
9/17/2003	1
10/18/2007	1
10/10/2008	1
10/15/2009	1
10/4/2010	1
6/7/2012	1
9/24/2012	1
10/8/2013	1

There are 0 time periods with multiple data

A = 510
 B = 0
 C = 120
 D = 0
 E = 30
 F = 0
 a = 6006
 b = 19656
 c = 364
 Group Variance = 305.333
 Z-Score = 1.31626
 Comparison Level at 90% confidence level = 1.28155 (upward trend)
1.31626 > 1.28155 indicating an upward trend

Mann-Kendall Trend Analysis

Parameter: Perchlorate

Location: MW-143

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

90% Confidence Level

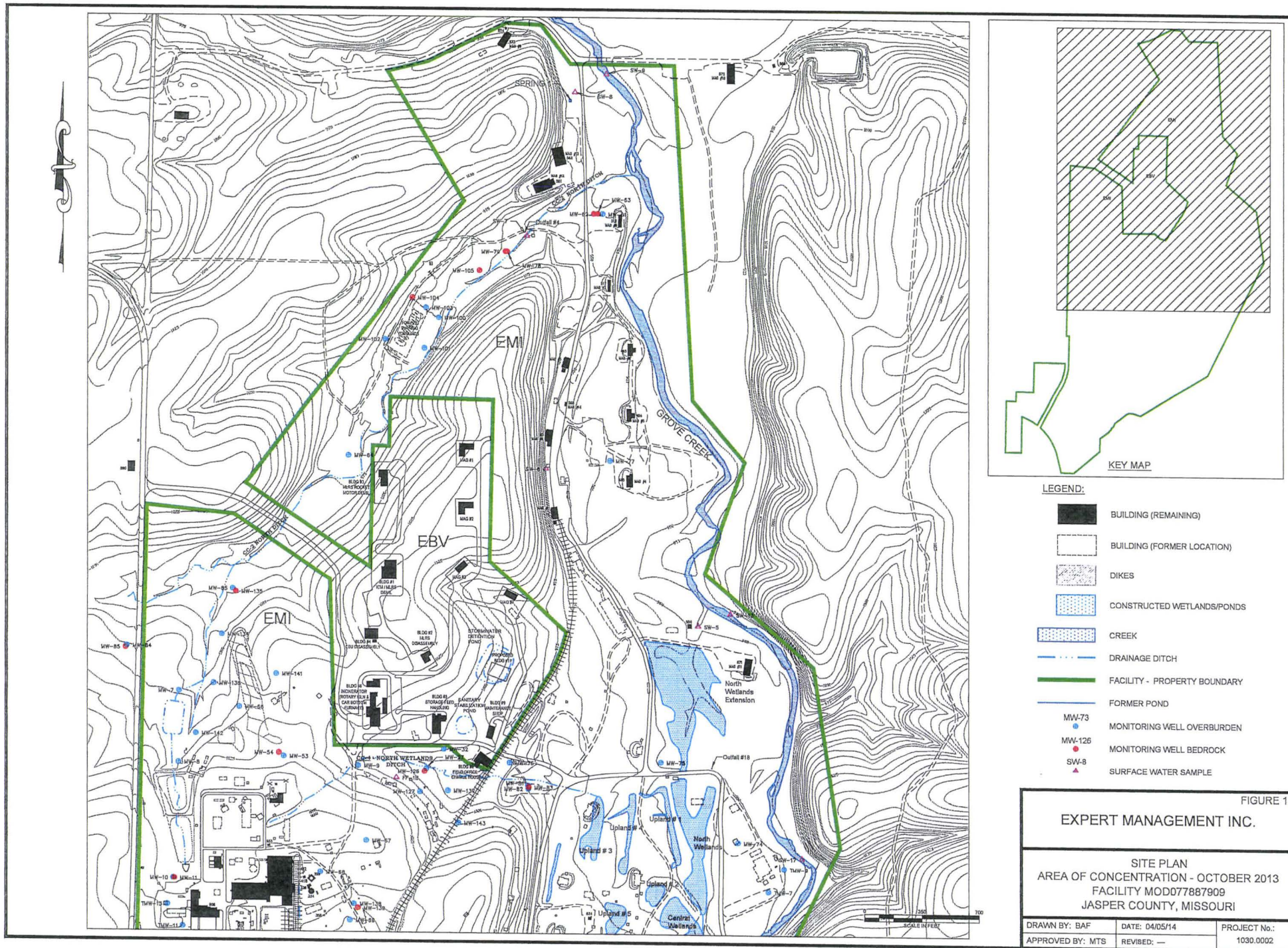
Xj	Xk	Xj - Xk	Positives	Negatives
5.6	9	-3.4	0	1
6.25	9	-2.75	0	2
5.5	9	-3.5	0	3
4.7	9	-4.3	0	4
6	9	-3	0	5
3.9	9	-5.1	0	6
6.25	5.6	0.65	1	6
5.5	5.6	-0.1	1	7
4.7	5.6	-0.9	1	8
6	5.6	0.4	2	8
3.9	5.6	-1.7	2	9
5.5	6.25	-0.75	2	10
4.7	6.25	-1.55	2	11
6	6.25	-0.25	2	12
3.9	6.25	-2.35	2	13
4.7	5.5	-0.8	2	14
6	5.5	0.5	3	14
3.9	5.5	-1.6	3	15
6	4.7	1.3	4	15
3.9	4.7	-0.8	4	16
3.9	6	-2.1	4	17

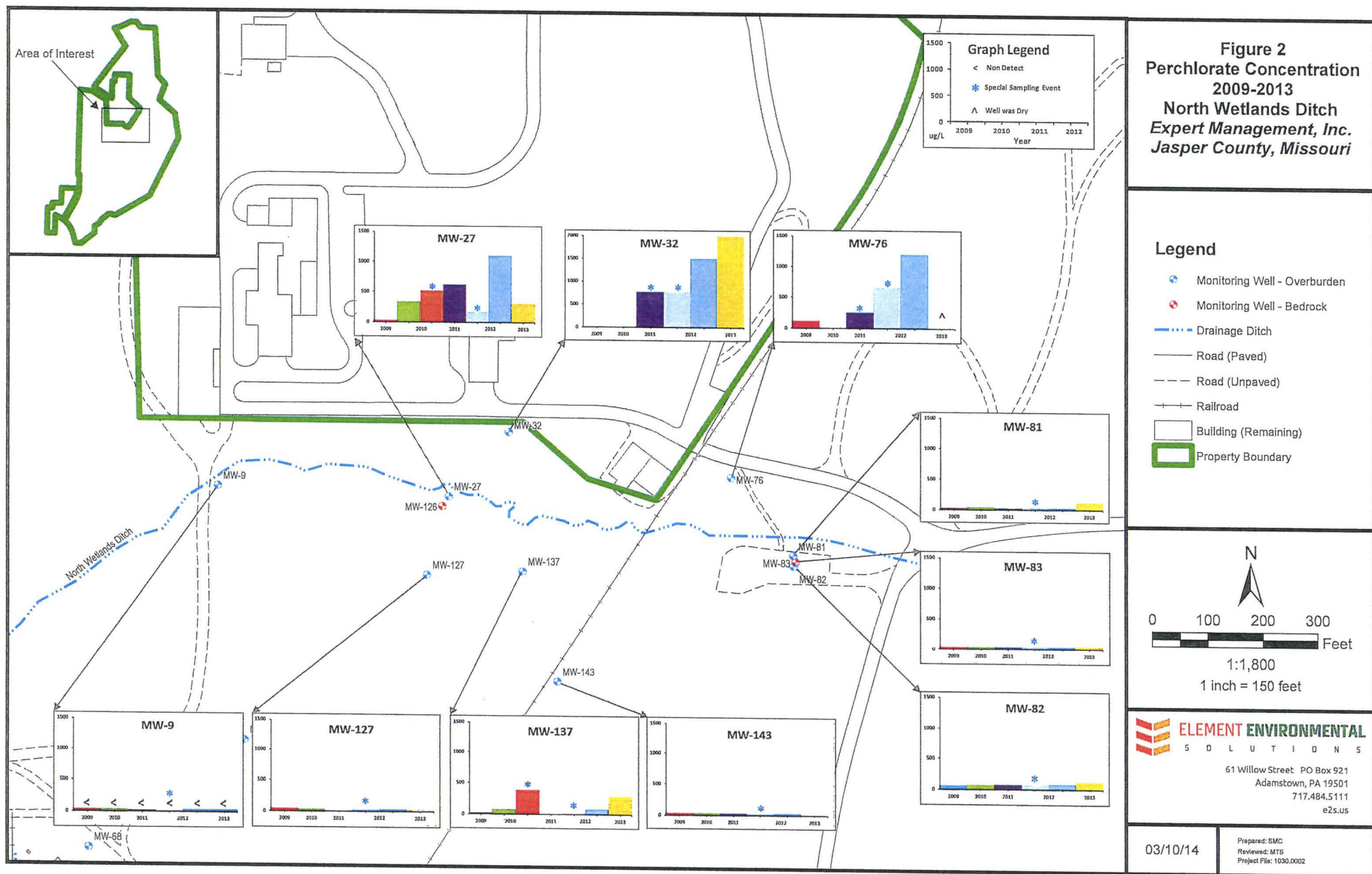
S Statistic = 4 - 17 = -13

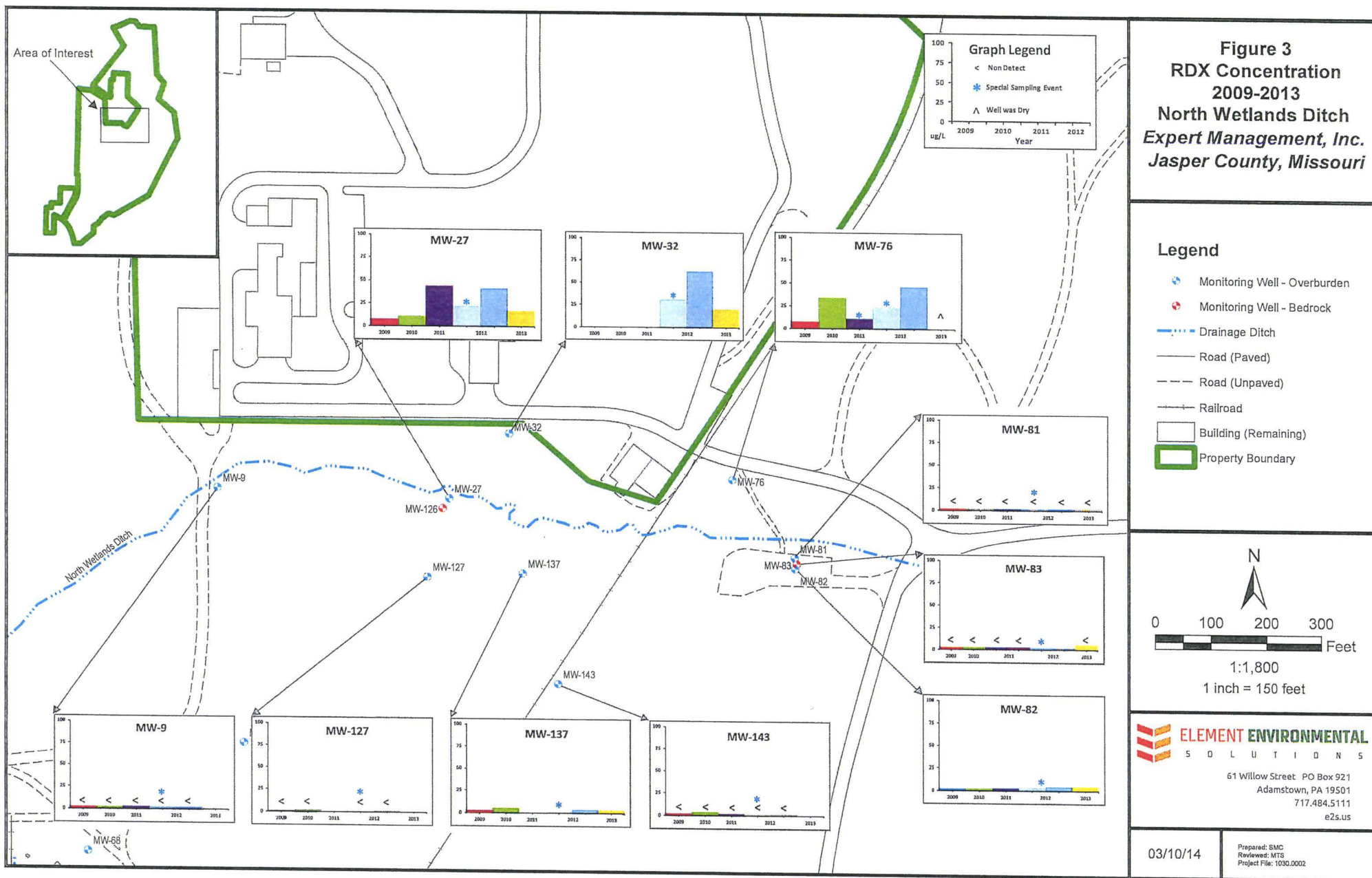
Comparing at 90% confidence level (downward trend)

Probability of obtaining S >= 13 is 0.035

S < 0 and 0.035 < 0.1 indicating a downward trend







EBV Stormwater
Pond





EBV Building #3

